



Discussion on VIIRS and Future Developments

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MODIS-VIIRS Science Team Meeting
19-22 May 2015





Continuity (MODIS to VIIRS2038)

- **Goal: Earth System Data Records**
- **How do we get there?**
 - **Measurements need to be sustained over decades - consistency**
 - **Quantify instrument and measurement performance (e.g. calibration, stability)**
 - MCST and VCST continuity
 - **Need to be able to **validate** our space-based estimated Earth system properties**
 - **Acquired from multiple sensors / datasets**
 - Aerosols, Clouds, Ocean Chemistry/Biology – PACE (and land capabilities?)
- **MODIS-T and A are old**
- **Suomi NPP VIIRS – “assessments” of continuity data products (& new) underway**
- **Are all VIIRS created equal (MODIS-T v. MODIS-A)**
- **Does VIIRS have the capability to produce all MODIS/EOS continuity data products?**
 - **If it does not, what is the solution?**
 - **If it does, then great, but there may be challenges to producing a given product (no PI to maintain/improve, time needed for assessment and continuity, etc.)**
- **Uncertainties associated with data products (more to come...)**
- **NOAA Data products – different? Better? Worse? Funding?**
- **Non-US sensors/missions**





Terra and Aqua & Suomi NPP VIIRS Algorithm Continuity

- **Orphaned algorithms and other activities that were not recommended:**
 - **Oceans NPP**
 - **Near-IR water vapor and cirrus reflectance**
 - **Validation of VI (MOD13)**
 - **Evaluate / improve MOD16 ET product**
 - **AIRS NH3**
 - **MODIS Angstrom Exponent**
 - **Surface Emissivity**
 - **VIIRS:**
 - **Atmosphere Gridded Product**
 - **Land Cover**
 - **Vegetation Continuous Fields**
 - **Atmospheric Pressure Vertical Profiles**
 - **Particulate Organic Carbon**
 - **Aerosols from OMPS**

Do we continue to produce these without an algorithm PI to manage?

For the products that we can attempt MODIS to VIIRS continuity, sounds as if many of these efforts are pushing ahead; however, quality assessments are underway in parallel, and it may be some time....





MODIS-VIIRS Measurement Teams

Historical Philosophy: Continuing/evolving measurement streams, there should be one science team, competed periodically, that provides scientific guidance to present and future missions and for the utilization of past data sets

- Support and focus on Earth System Data Records
- Data system to ensure a “seamless” time series
- Scientific guidance and priorities must represent broad user community (including outside of NASA/U.S.)
- Suomi NPP VIIRS continuity, DS missions, CI missions, international missions
 - T&A/Suomi NPP Competition circa ROSES 2016/2017
- JPSS – VIIRS continuity out to 2038, plans for NASA ST?





ATBD/Data Product Documentation & Reviews

- **ATBD/Data Product Documentation and Reviews:**
 - Documentation on web sites lacking for Sensor/Team/ATBDs/Data – new (and existing?) users (especially in the applied/operational world) need to find the details
 - Could we envision something like this on line:
 - MODIS PRODUCT / CORRESPONDING VIIRS PRODUCT / COMMENTS / NASA funded & RELATED RESEARCH / REFERECES
 - Snow Cover (MOD10A) / Snow Cover (VIIR99) / Loss of spatial resolution, no loss of accuracy / D. Hall currently doing VIIRS error assessment
 - Land: ATBD and User Guides
- MUST list key references – ex. Snow cover see Hall et al 2014, Painter et al 2015
- PI's maintain algorithm data on central page (MODIS? VIIRS? Pointers)
 - Review of algorithms for new & alternative MODIS (VIIRS) algorithms
 - Is the structure of the original EOS ATBDs needed? Can each disciplinary community propose an approach like the above?
 - **New algorithms/data products** – draft new proposals, documentation and requirements, follow with review and endorsement by user communities (benchmarking).
 - Is there a need for periodic review of ATBDs/Algorithms off-cycle of the competition?
 - What about the guidance we should include in the next competition?



Scientific Issues for future T&A & Suomi NPP Program Elements



- Algorithm **history** needs to be clear – continuations requested with no work showing history to core algorithm(s)
- Algorithm **improvement** needs to be clear – continuations requested with no work showing progress or improvement to uncertainty(ies) in core algorithm(s)
 - All proposals must quantify errors and uncertainties associated with proposed efforts (e.g., the data products themselves, any scientific data analysis, etc.)
 - Or can we just start with assumptions/qualitative analysis?
- Algorithm **relevance** needs to be clear –people will use the product, but what for?
- Is the approach at the state of the art – is there a better approach/data product NASA should be considering? Do we continue to produce standard products if they are “inferior” or not innovative (think about operational uses and the time it takes to transition a new model to operations)
- What’s the cost associated with progress relative to the science return?
- Transition core standard algorithms to the Senior Review
 - a huge range of cost (\$50-550K/yr) with individual core algorithm proposals and MINOR associated calibration/validation activities
 - Funds are likely to come out of the core Science of Terra and Aqua Competition
- Can we link current and future sensors, Aqua to Suomi-NPP to JPSS or other mission for continuity?
- Interdisciplinary and multidisciplinary science





Outstanding Programmatic/Senior Review Issues – Terra

- Terra's fuel reserves will drive a question we need to answer by 2017: **how important is it to continue the Terra data record (which of course includes MODIS) with a tightly-controlled 10:30 MLT?**
- Could lower the s/c which leaves it closer to the constellation, but still safe – BUT needs additional waivers for violating international orbital debris standards. If we get waivers, ESMO's new approach will continue to maintain 1030 MLT until 2021, which would give us a 20-year data record with a tightly-controlled, consistent MLT. Total operational lifetime of Terra would be the same (whatever approach used) - post-mission lifetime will increase by 20 years.
- Senior Review panel recommended NASA quantify the impact to the CDR quality of the Terra datasets if the MLT drifts off 1030 beginning in 2018, compared to 2021.
- Fate of the waiver to extend the Terra mission at the current 705 km altitude.
 - Waiver is approved - Terra will maintain the 10:30 MLT for 3 additional years and continue to provide a long term uninterrupted data record.
 - Waiver is denied - Terra would continue to collect high quality data of sufficient value to the science community to warrant extension - orbital change would compromise continuity of the stable long term climate record at some level, but additional information necessary to fully assess the significance of this degradation (workshop of stakeholders)
- What do we do for a MODIS-quality instrument in the morning orbit when Terra is done?????)



Issues for MODIS-VIIRS Science Team



- Terra's future data quality for MODIS assessment in community workshop (waiver on MLT/altitude adjustment)
- Evolution/migration of Existing Algorithms to Senior Review (2013 program element, A.46 as intermediate step) – we have to weigh investments versus potential outcomes
- Continuity of products and orphan products (from MODIS and VIIRS)
- Algorithm developers and validation investigators should continue to address important deficiencies in key data products (uncertainties)
- Algorithm developers need to represent broader community needs by working with them
- How best to facilitate interdisciplinary science and algorithm development approaches, Terra/Aqua intersensor science (2.1.1)
- Established web site(s)/process for regular data product and algorithm reviews -need to maintain, evolve, refine, review data products as needed (but can no longer say “go to the literature”)
- **MODIS and Suomi NPP VIIRS website and data product documentation – updated and coordinated with discipline leads, team leader, project scientists, and PIs – more user friendly**
- Evolution to measurement teams and blend with MODIS-VIIRS Team (w/other mission teams)
- Reprocessing – “staged delivery”

